THE TELEGRAPH IN AMERICA.

The origin of a great invention is like the source of a river: the more carefully you explore it, the more difficult does it become to discriminate between rival claims, and decide where and when it actually took its rise. During the age of religion or fiction, when the practical philosopher was unborn, seven cities disputed the honour of having given birth to Homer: during that of exact sciences, history counts pretenders to the honour of the invention of gunpowder, printing, the steam-engine, and the telegraph, by the dozen. Each nation has a favourite candidate; each city, each college, has something to advance in favour of its exclusive right. M. Quetelet asserted, in the bulletin of the Royal Academy of Science at Brussels, that the discovery of the electric telegraph was claimed by sixty-two persons, all of whose pretensions were founded on some shadow of reason. And if we endeavour to retrace the steps which the science of telegraphing has made, from the delicate and ingenious telegram of House, to the earliest attempts to give intelligence to the spark, we shall find it almost impossible to put our finger on the exact period or the exact laboratory where the invention first saw the light. Like the towering front of some massive edifice, the telegraph has been reared by many hands: to ascribe the glory to any one would be like awarding the prize of architecture to the mason who buried the first stone of the foundation, or who superposed the last cornice of the pediment.

Not that we can refer with unconcern to the experiments of Le Monnier, who, in 1746, demonstrated that the electric discharge could be transmitted through metallic circuits of almost any length, that water was a conductor, that the velocity of the spark was appreciable;—to those of Jehan Winkler, of Leipsic, who corroborated the principles established by Le Monnier;—to those of Dr. Watson, who proved that dry land was as good a conductor as water;—to those of Franklin, who methodised the science, and gave it a tangible shape. More than a century has elapsed since these philosophers gave their discoveries to the world; but the long period which divides the first theoretical principle from the final practical application, does not impair their claims on our gratitude. The perspective through which we contemplate their services does not render their outline indistinct.

The seed they scattered had germed for a quarter of a century, when a Genevan philosopher conceived the idea that thought could be conveyed to great distances by sending the electric spark along an insulated wire, and attracting or repelling a pith ball at the end. Twenty-four wires represented the alphabet; and M. Lesarge, by connecting each wire alternately with his battery, actually contrived to spell out words. Here was the telegraph in its rude embryo. But Lesarge, like many other great men, was in advance of his age: philosophers scoffed at his instrument, wits pointed epigrams at his schemes, and the superstitious citizens of Geneva, constantly alternating between tolerance and bigotry, gave him the benefit of the latter characteristic. A Frenchman, named Lomond (L'Homond?), performed similar feats with a single wire, the signals being distinguished by the number and nature of the divergences or attractions of the pith ball. But his scientific countrymen did not condescend to notice his invention; and we might never have heard his name, had not an English traveller, named Young, left us a brief account of a visit to his room. About the same time (1785), a wire twenty-six miles long was laid down between Aranjuez and Madrid, and signals were transmitted by means of a battery of Leyden jars. Reizen substituted for the pith balls strips of metal placed upon a square of glass, each strip being divided by several breaks. The electric spark, passing through each of these breaks, illuminated the strip, and thus conveyed intelligence. Cavallo's signals were made by counting the sparks. Salva invented a telegraph in 1796, and exhibited it to the "Prince of Peace," who used it, we are told, to procure news on important occasion; but its principle seems to have been lost.

Thus, at the close of the eighteenth century, the idea of communicating thought by means of electricity was already familiar to men of learning in every civilised country of Europe and in the United States. The crude notion was afloat; but the essential element—which even Franklin, who was confident that his descendants would converse across the Schuylkill by means of wires, had not dreamt of—electro-magnetism, was yet wanting.

We must skip over a period of some nine or ten years, during which Luigi Galvani stumbled on galvanism by trying to resuscitate a dead frog. Alessandro Volta built his pile, and Nicholson, Carlisle, Davy, and others, astonished the world with their discoveries of the chemical properties of the galvanic current. A German named Sœmmering has hit upon the notion of making the decomposition of water by the galvanic fluid a vehicle for thought. Thirty-five wires lead from his laboratory to the station with which he wishes to communicate, and are understood to stand for the German letters and numerals. By sending a stream of galvanic electricity through one of these, a small bubble of air rises from the water at the further end, and the bubble means A, B, C, D, E, 1, 2, 3, 4, or 5, according to its position in the receiving trough. The members of the Academy of Sciences, at Munich, open their eyes; the days of persecution being over, Sœmmering is neither hooted in the streets nor burned at the stake: but the authorities do not seem willing to advance him the 2,000 florins he required to construct a telegraph a mile long. Meanwhile, Ronalds, in England, is making a retrograde step, and consuming his energies in trying to invent a working telegraph with free electricity.

Fortunately about this time, a Copenhagen professor, named Oersted, restored the credit of the galvanic battery, by proving that a magnetic needle always tries to place itself at right angles to a neighbouring wire which is charged with a current of galvanic electricity. This was, perhaps, the most brilliant scientific discovery since the construction of the voltaic pile. The new element—electro-magnetism—was destined to work miracles. It was eagerly caught up by *savans*, and M. Ampère, in 1820, invented the first telegraph based on the combined effects of the voltaic pile, the charged wire, and the magnetic needle. He used as many needles and wires as there are letters; by closing the current with any one of the wires, the needle at the other extremity of the line moved, and the letter which it represented was designated. This was the primitive stage of the Wheatstone telegraph, now generally used in Great Britain. M. Ampère also discovered that a piece of soft iron, placed in the centre of a coil of wire through which a galvanic current is passing, becomes an electro-magnet, and attracts iron. This is the main secret of the Morse telegraph.

M. Ampère's discoveries made as much noise as such things usually do. But when people spoke of putting it in practice, the learned Professor Barlow, proved by $a+b$ that the force of the galvanic current would be so diminished by distance, that it would be impracticable to use it for long distances. Strange to say, notwithstanding this dogmatical decision, Baron Schilling had the monstrous audacity to build a telegraph working with a deflective needle on Ampère's plan, at St. Petersburgh, in 1832; and what is still more unaccountable, he actually succeeded! By employing five needles, and causing them to deflect to the right or left as he wished, he obtained ten intelligible signals, and astonished the Czar Alexander, by holding a conversation with a person at a great distance. With equal disregard for the feelings of Professor Barlow, Messrs. Gauss and Weber built a telegraph between the Observatory and the Cabinet de Physique, at Gottingen—a distance of a mile and a quarter—and conveyed their thoughts by means of the deflections of a single needle; and Steinheil erected twelve miles of wire, with a more elaborate instrument, at Munich. The latter is chiefly remarkable as being the first who employed a registering apparatus on

an electro-magnetic telegraph. His needles were armed with pens filled with ink, which marked dots on a paper drawn up before them by mechanism.

We have now approached the period when the telegraph began to be practically and successfully employed. In the same year in which Steinheil erected his telegraph at Munich, 1837, Professor Wheatstone patented his improvement on Ampère's plan in England. Nor was America idle. The mantle of Franklin had descended to others. Dr. Coxe, of Philadelphia, had shown, in 1816, how the decomposition of water by the galvanic current might be used as a telegraph. Mr. Dyar, of Long Island, had actually contrived, in 1826, a registering telegraph, worked with common electricity: the sparks from his wire discolouring a litmus paper which was made to revolve under it. Professor Henry had demonstrated that the earth was a good conductor for voltaic electricity, and had produced the most powerful magnet known. In September, 1837, Professor Morse announced to the Secretary of the Treasury that he was prepared to demonstrate the "practicability of telegraphic communication by means of electro-magnetism." A patent was forthwith issued in his favour, and in 1844 his registering telegraph was introduced upon a line between Baltimore and Washington. In June, 1846, Mr. O'Reilly, an associate of the professor, sent the following message from New York to Washington:—

"Henry O'Reilly congratulates Professor Morse on the completion of the telegraph, and on the connexion of the Hudson and the Potomac by links of lighning."

The following reply was received a few moments afterwards at New York:—

"Professor Morse congratulates Mr. O'Reilly on the success of his labours."

The Morse telegraph is based on Ampère's discovery, that a bar of soft iron enclosed in a coil of wire becomes a magnet while a stream of galvanic electricity is passing through the wire, and ceases to be one when the current is interrupted.

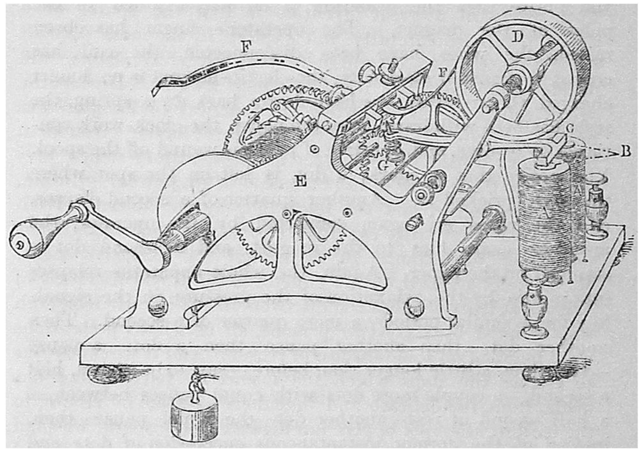
It is hardly possible to convey a clear impression of so ingenious and complicated an instrument as the Morse telegraph by a verbal description, and more especially in the brief space allotted to us. We shall, however, attempt to sketch its leading features.

The electricity is generated by a Grove's battery, consisting of several pairs. Each pair is a glass tumbler, within which stands a zinc cylinder, which encloses an earthen vessel, in which a strip of platinum is suspended. The earthen vessel is filled with nitric acid, and plunged into diluted sulphuric acid contained in the glass tumbler. It is stated that this battery will act uniformly for three weeks; but this, we presume, supposes that the pairs are taken down every night. The number of pairs employed depends on the resistance to be overcome, or, in other words, the distance to be traversed by the message; as many as fifty pairs are employed on a line two hundred miles long. Through two screw-cups above the battery the negative and positive wires are passed. One of these wires is connected with a metallic plate buried in the earth. The other is carried on stout poles, from which it is isolated by glass supports, to the distant extremity of the line.

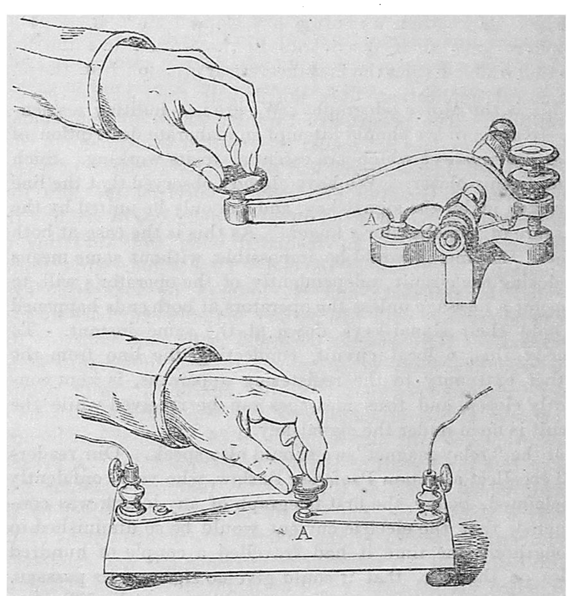
The registering apparatus has been already alluded to. It consists of a powerful U-shaped electro magnet, round each limb of which coils of fine copper wire are wound. The armature of the magnet is attached to the short arm of a lever, the long arm of which carries a style. Close to this style a large spool, on which an endless strip of paper is wound, is made to revolve by clock-work. The following sketch may elucidate the description:—

A A, coils of wire through which the fluid passes.
B, the electro-magnet round which the wire is coiled.
C, the armature of the magnet.
D, the spool kept in constant revolution, when the instrument is at work, by
E, a clock-work apparatus.
F, a strip of paper for receiving messages.
G, the long arm of the lever with style attached.

It remains for us to describe the "signal-key" by which the message is transmitted. We have explained that, by means of



the wire carried on the telegraph posts, and the earth which acts as a conductor, a continuous chain is formed between the two places or cities which it is desired to connect. In this chain there is but one break, and that is the signal-key, which is placed beside the registering apparatus. In other words, the two wires are at that point disconnected by a space of an eighth of an inch or so, but may be brought together by the pressure of the hand of the operator on an ivory knob at the extremity of the key; the contact (which is called closing the circuit) produces a stream of electricity; so long as the wires remain separate, no current passes. The following sketches represent the signal-key in its simplest form, and the more perfect instrument called a signal-lever. Both operate in a similar manner.



Let us suppose now that an operator at New York wishes to ask his friend at Boston how he is. The process is beautifully simple. We have mentioned that the only break in the line which prevents a stream of electricity passing through the wire occurs at the signal-key, exactly under the finger of the operator in the sketch. By a slight pressure of his finger, the two wires will be brought into contact at the point A, and a flood of electricity at once rushes through the wire. The piece of soft iron wound round by the coils of wire, at the other end of the line, at once is charged with electricity; the armature is forcibly attracted to it, and the style which is attached to the end of the armature is thrown up against

the strip of paper on the roller. The clock-work has begun to revolve,—a quarter of a second has elapsed since the operator's finger first pressed the signal-key, — and you notice that the armature is no longer glued to the poles of the magnet. The operator's finger has been raised, the wires have been disconnected, the coil has ceased to transmit electricity, the electro-magnet is no longer charged, the armature has been drawn back by a spring, the style has been withdrawn from the paper, the clock-work continues to revolve, and the strip of paper is wound off the spool. You notice that a mark, a dot, is left on the spot where the style pricked it. Another quarter of a second elapses, and the wires are again connected by the operator, the armature again flies to the magnet, and a second dot is stamped on the paper. Again, the whole apparatus relapses into inertia by the relaxation of the pressure on the signal-key for a similar period—a mere quarter of a second. Then another dot — then another pause—then a dot — a pause —this time, a little longer than before,—say, to be liberal, half a second,— a couple more dots with equal pauses between,— a half second of rest—another dot—the usual pause—then, instead of the former instantaneous succession of dots and pauses, the armature rests firmly attached to the magnet for the enormous period of a second. You look anxiously at the paper to see the result. Instead of a dot, the style has scratched a plain long line—and after the usual brief gap— another similar one. For the reader's sake, we will suppose that, after this, you are content to wait till the armature has ceased to jerk up and down, and to read the dots and scratches on the paper *en bloe*. They will present the following appearance, which to you may not seem very significative.

- - -   -   -   - — —   — —   -   - -   -   - - - -   - -   - - —

The operator, however, who is standing beside you, will read it as easily as the finest Roman of Elzevir or Didot. He says it means, "How are you?" and accordingly replies:—

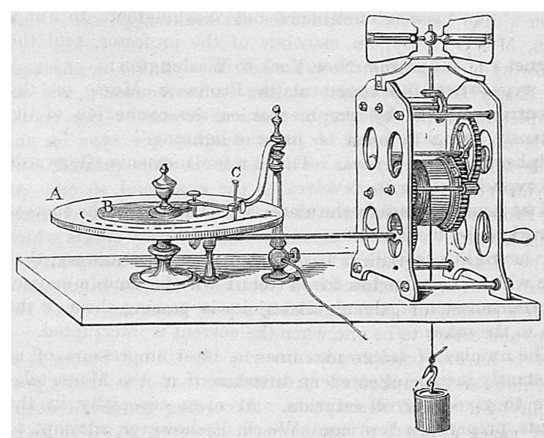
- - - - -   - - -   -   —   —   - - - -   - — —   -   ——   ——
P r e t t y   w e l l

—   - - - -   - —   — -   — - —   - - - -   - -   - - —
t h a n k   y o u

This is the Morse telegraph. We are not inditing a scientific treatise, or we should attempt an elaborate description of other contrivances which are essential to its working. Such is the circuit-closer. We have already observed that the line is broken under the signal-key, and can only be united by the pressure of the operator's finger. As this is the case at both ends of the line, it would be impossible, without some means of closing the circuit independently of the operator's will, to transmit a message unless the operators at both ends happened to hold their signal-keys down at the same instant. To remedy this, a local circuit, connecting the line from the further extremity to the registering apparatus, is kept constantly closed, and thus messages can be received while the circuit is open under the signal-key.

Of the "relay magnet" we should also speak. Our readers will recollect a certain Professor Barlow, who very confidently proclaimed, before the first telegraph of any length was constructed, that the electric current would be so diminished in strength by the time it had travelled a couple of hundred miles on the wire, that it could give no signs of its passage. The professor, like many ultra-conservatives, saw the difficulty, but did not see the means of getting over it. He was right in asserting that the atmosphere and the earth, though very poor conductors, would, notwithstanding, carry off a large portion of the current on a long line; but he never dreamt of a relay magnet with a local circuit. In other words, the idea of a small telegraph within the office, with wires and a battery of its own, so contrived that it can be worked, i.e., its current closed, by the feeble spark from the main line, had never occurred to him. Professor Morse discovered that a very weak current would suffice to work this local battery, and that this latter would work the register with energy. He adopted the system; and though, for simplicity's sake, in describing the working of the Morse instrument, we omitted all mention of the relay magnet, and supposed that the current from the other end of the line communicated directly with the register, in point of fact the register is always worked by the local battery in the office. On long lines, the diminution in the intensity of the current produced by contact with the atmosphere is counteracted by what are called repeating magnets, which are similar instruments to the relay magnets. By the aid of Bulkeley's repeating magnets, a message can be sent directly from New York to New Orleans, a distance of nearly 2,000 miles.

Besides the Morse telegraph, two other systems have been in operation in the United States. Bain's patent was a modification of Morse's, the only difference being the substitution of a chemically-prepared paper, which is marked by the passage of the current, for the plain strip with the moveable style described above. In other respects they coincide so closely, that the courts of justice have decided that Bain's telegraph was an infringement on Morse's patent, and the two systems are now incorporated. The following sketch will convey some notion of the Bain instrument:—



A, a revolving ring of paper moistened with a solution of yellow prussiate of potash, and acidulated with nitric or sulphuric acid.

B, a brass spiral groove, in which a metal guide to the pen travels.

C, the pen-wire, through which the current passes to the paper.

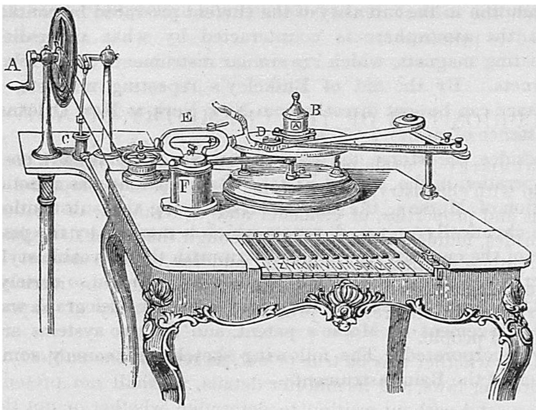
When the current is closed, the pen wire discolours the paper, and leaves blue dots or lines. When it is open, if the clock-work revolves, it leaves no trace of its passage.

A third instrument, that of House, is perhaps more celebrated in America, though less generally used than Morse's. It is called the printing telegraph, and works on the old principle of designating each letter by a given number of electrical impulses.

The operator sits at the key-board, and presses down the key bearing the name of the letter he requires. Under the key-board is a horizontal cylinder, which is made to revolve by means of the crank A. This cylinder is connected with the telegraphic wire by a wheel at one end, armed with fourteen cogs which touch the wire and so close the circuit fourteen times during each revolution of the cylinder. When any given key is pressed down, a spring underneath it stops the cylinder, and the internal mechanism is so contrived that when the key-spring checks its progress, it has performed the portion of a revolution (i. e., it has closed and broken the circuit by means of the cogs the exact number of times) corresponding to the letter inscribed on the key.

It would be almost impossible to describe intelligibly the mechanism by which the type-wheel of House's telegraph is made to work. It may suffice our present purpose to say, that it (the type-wheel) is made to revolve by means of a spring and a little atmospheric engine, worked by a condensing pump

C, and moving an escapement at D. The direction of the current of condensed air is changed twenty-eight times during each revolution of the cylinder, by means of the vibration of an iron rod E, suspended by a fine wire over a powerful electro-



HOUSE'S PRINTING TELEGRAPH.

magnet F. When the revolution of the cylinder is checked, the type-wheel is stopped at the same moment; and an eccentric, worked by the mechanical power at the crank, instantly brings a band of paper against the type on the periphery of the wheel. The letter is thus printed, and the type-wheel again revolves to the next, and so on. As will be remarked, nearly the whole of this ingenious mechanism is worked by local mechanical power: the only effects which can be rightly ascribed to electricity are the uniformity of rate which is attained in the movement of the machinery, and the transmission of the regulating power from one end of the line to the other.

The number of telegraphic lines in the United States is so constantly increasing in every direction, that it is hardly possible to give a correct estimate. According to official documents, prepared a few months back, however, 20,047 miles of wire were erected and used in the country. They were distributed as follows:—

Morse Lines..........	70 wires	15,835	miles in length
House ,, ...	6 ,, ...	2,200	,,
Bain ,, (now Morse)	6 ,, ...	2,012	,,
		20,047	

The following are a few of the longest lines:—

	Miles.
New York to New Orleans, *via* Charleston, Savannah, &c. (Morse), 1 wire	1,966
Washington to New Orleans, *via* Richmond (Morse), 1 wire..	1,716
New York to Buffalo, *via* Troy and Albany, (Morse), 3 wires each	513
Calais to Halifax, *via* St. John's (Morse), 1 wire	400
Buffalo to Milwaukie, *via* Cleveland and Chicago (Morse), 2 wires each...........................	400
Columbia to New Orleans, *via* Tuscumbia (Morse), 1 wire..	638
New York to Buffalo (Bain), 2 wires each	513

The House Company are now constructing a line to St. Louis, the whole length of which, when finished, will be 1,500 miles, and many thousand miles of line are in construction by the other companies.

At the present day, a continuous line of telegraph extends from the extreme limits of civilisation on the west, to the ocean on the east; and, ere long, the Pacific shores will form part of this vast network. The route to San Francisco has already been pointed out, and approved by the Committee on Post-offices and Post-roads. "It will commence," says the report, "at the city of Natchez (Mi.) running through a well-settled portion of Northern Texas to the town of El Paso, on the Rio Grande, in latitude 32°; thence to the junction of the Gila and Colorado Rivers, crossing at the head of the Gulf of California to San Diego on the Pacific; thence along the coast to Monterey and San Francisco. The whole distance from the Mississippi to San Francisco will be about 2,400 miles." Mr. Henry O'Reilly offered, within two years from this time, to deliver the European news on the shores of the Pacific one week from the time it left the European continent, if he were permitted to build a line from the Mississippi, and protected by a chain of military posts."

Another important line of telegraph is that from New York to St. John's, Newfoundland. The grantees, Messrs. Tibbats and Company, are now busily engaged in erecting the posts on the island, and sinking the submarine portion of the line. As soon as it is completed, it is their intention to run a line of steamers from St. John's to Galway, there to connect with a telegraph from Galway to London. By this means, as the distance from St. John's to Galway is only 1,647 miles, it is expected that the distance between New York and London will be traversed in five days.

In America, everybody makes use of the telegraph. The merchant who has left his wife in the country to transact business in the city telegraphs an inquiry about her health before he goes to his counting-house in the morning. Half the operations on 'Change and in the produce and cotton market are performed by telegraph. Your friend who lives on the Hudson telegraphs you that he will be happy to see you at dinner that day, and you reply forthwith "most happy," or "engaged," as the case may be. We have not reached that stage of perfection which thunderstruck the old lady whose "*umbrella*," she was assured, had been forwarded by telegraph; but we can draw and remit money as easily as by mail. Some people have lines of their own. Mr. Norton, the telegraph manufacturer, has a line from his office in Broadway to his manufactory in Centre-street, and can transmit an order to his clerk or foreman without stirring from his seat, or trusting to a messenger. Of the business of the lines, some conception may be formed from the fact that during the last six months of 1851, 99,313 messages were transmitted, at a cost of 34,733 dols., over the lines of the Magnetic Telegraph Company from New York to Washington; and during the first six months of 1852, the number of messages was 154,514, being at the rate of 849 messages a day. The receipts of the company, which were only 4,228 dols. in 1846, were 103,860 dols. last year.

The business of a telegraph operator is not a pleasant one. He has very heavy responsibilities; and if anything goes wrong—if people misdirect their messages, or make mistakes in writing them—the blame is sure to fall upon him. Here, in America, where news is a merchantable commodity, many unprincipled persons earn a livelihood by gleaning scraps of imaginary news from the city newspapers, or manufacturing them themselves, and sending them on to the country papers. When their inaccuracy is discovered, the blame is always laid on the shoulders of the operator. He is bound to know the person who hands him a message, and to be satisfied of his identity; but he has no right to refuse to transmit a message without very well-founded grounds of suspicion. He is bound to send on the message, letter by letter; and at the same time he is visited with the severest punishment his employers can award if he divulge its contents. This, we are told, becomes at last a very easy matter. The telegraph operator becomes after a few months' work a mere machine: he either does not realise the sense of the letters he writes, or forgets the purport of the message ten minutes after it has passed through his hands. In general, he is a taciturn, suspicious-looking individual, gifted with great clearness of head, and a precision of judgment in examining faces, far above the average. The best telegraph operators are taken from among the Post-office clerks. They are constantly exposed to accidents, owing to the action of the lightning on the lines, notwithstanding the conductors erected for their protection. A few months ago, the operator at the House's telegraph in New York was severely injured by the explosion of a charge of natural electricity at the battery; and similar accidents are not unfrequent though we have not heard of an instance which

terminated fatally. To cap the whole, the rates of remuneration are not such as to make the post a very enviable one in a pecuniary point of view.

Honest Mr. Ronalds, of Hammersmith, who made some improvements on the telegraph in 1816, winds up a piece of sound advice to telegraph owners and operators, as to their treatment of "mischievously disposed persons" who might cut the wires, with the following words :—"Should they (the mischievously disposed persons) succeed in breaking the communication, hang them if you catch them, damn them if you cannot, and mend the wire immediately in both cases." It would have been well if the first, at least, of Mr. Ronalds' suggestions had been acted on in this country some time ago. It was constantly the practice for news-agents, after having telegraphed the news of the English steamer from Halifax or Boston to the journal by which they were employed, to endeavour to secure a monopoly for it by cutting the wires; and, strange to say, none of them were ever brought to punishment for their villany. Crimes of this description are much rarer at present. A close watch is kept on the movements of suspicious individuals by those through whose property the telegraph passes, and who feel that every man in the country is interested in its preservation. Some time ago, a man who was detected in cutting the wires in South Carolina, narrowly escaped being "lynched" by a party of infuriated citizens who caught him in the act; and there can be very little doubt that a jury would show no mercy to a similar offender who might be brought before them.

One of the most novel feats performed by the telegraph in America is transmitting intelligence in advance of time. Some years ago, as the clerk of the House of Representatives began to read the President's message, the telegraph operator began to transmit it to St. Louis. He kept pace with the clerk, and was seldom more than a few lines behind him. At St. Louis, printers were in attendance at the telegraph office, and set it up almost as fast as it arrived. Five minutes after the peroration was delivered at Washington, the last page of the message was in the steam-press at St. Louis: and a few minutes afterwards (viz., *at half-past twelve*, P.M.) boys were hawking in the streets the document which the clerk was still reading at Washington at *half-past one*. According to the clock, the inhabitants of St. Louis, who were 1,500 miles distant from the spot where the speech was delivered, heard it, and read it, an hour or more before those who were sitting in the hall where it was read. This difference of time between the eastern and western cities sometimes give rise to funny mistakes, which our readers will readily conceive.

In the present age, he is a bold man who can say to science, "Thus far shalt thou go, and no farther." We can only look with amazement at the projects which are mooted every day, of submarine telegraphs across the Atlantic; or lines of wire, like Puck's girdle, encircling the earth in forty minutes. Easy, indeed, is it to suggest obstacles to either—to allude to the impossibility, under our present arrangements, of charging a wire with such a quantity of electricity, that the best conductors known will not absorb it in a distance of upwards of 300 miles—to the constant accidents which are happening in our present lines, and which it would be almost impossible to detect and counteract in a submarine or subterranean line of a thousand miles in length—to the sheer absurdity of "telegraph stations" on the ocean, or amid the wilds of North America, or the ice-bound forests of Kamskatka—any schoolboy can raise these difficulties, and put them in a formidable shape. Whether the man of science is destined to overcome them is a question to which, however dangerous it might be to answer boldly in the affimative, it would be both dogmatical and unreasonable to offer a decided negative. The earth, air, water, every known substance is, as we have seen, a conductor. A line carried round from New York to our Antipodes would constitute a perfect telegraphic circuit, according to modern writers. The fluid transmitted into the earth at either end, would instantly traverse the centre of the globe to rejoin the end of the wire buried at the other extremity. Who knows, but that, a few years hence, the electric fluid will be traversing in every direction, with its own peculiar instinctive sagacity, the bowels of the earth; and, besides drawing the colonists of Western America into close proximity with the nomade tribes of Africa or Asia, will disclose to an astonished world those mysteries which the science of the geologist and cosmogonist have not dared to penetrate?

CURIOSITIES OF THE CHEMISTRY OF ART.

"CHEMISTRY!" exclaims, perhaps, the reader, "What have I to do with chemistry, or it with me? It is a dry compound of signs and properties, of elements and equivalents, of oxides, chlorides, iodides, and salts—a fit enough theme for druggists' apprentices behind the counter, and for embryo doctors in college laboratories, but quite unworthy, either in intrinsic interest or in the results produced, of the study of unprofessional people."

Now, whether this be true or not, as regards the subject in its broader laws, and its minuter details, we shall not pretend to say, and without waiting to determine whether or not the repulsive forms of the science might not be modified into something more of attractiveness, we have simply to remark that there are many facts which the chemist has brought to light, and many curious processes—with the results of which we all have habitually to do—which are deserving the attention even of those who may be least interested in the technical exposition of chemical laws. And when it is remembered, that every form of matter with which we may have to do, whether it be in the world around us, or in our own bodily organisation—whether it be the simplest food we eat, or the clothes we wear—has been passing through delicate and beautiful processes of nature or of art, surely entire ignorance of all of them will not be defended. To a few of these we would now, very briefly, invite the attention of the reader.

The operations of chemistry have brought into employment a thousand substances which had otherwise been useless or pernicious. Like a prudent housewife, she economises every scrap. The horseshoe nails dropped in the streets during the daily traffic, and the bits of old iron which have been rusted in the timber of buildings, are moulded into the form of musket-barrels. The ingredient of which the ink which tracks its muddy route over this paper, was once possibly part of the broken hoop of an old beer-barrel. The bones of dead animals yield the chief constituent of the explosive element employed in the formation of matches. The clippings of the travelling-tinker are mixed with the parings of horses' hoofs from the smithy, or the cast-off woollen garments of the poorest inhabitants of a sister isle, and soon afterwards, in the form of dyes of the brightest hue, grace the dress of courtly dames. The dregs of port-wine, rejected by the drinker in decanting it, are taken by him in the morning, in the form of seidlitz powders, to aid in the removal of the effects of his libation. The offal of the streets, and the washings of coal-gas re-appear in the lady's smelling-bottle, or are employed by her to flavour blanc-manges for her friends.* Such is the economy of the chemistry of art, which, by the combination of apparently useless elements, produces, as though with the touch of an enchanter's wand, order out of confusion, advantage and beauty from the offensive and the injurious. And in these processes there is but an imitation of those of nature. Animals and vegetables live and die, and from their mouldering forms are given off into the atmosphere the materials from whence other races derive their means of subsistence, and thus the death and destruction of one generation furnishes the food and support of the next. Let us trace two or three of these operations more in detail, as illustrations of some of the myriad curiosities of the chemistry of art.

The processes which are gone through in the preparation of common carbonate of soda, or British alkali, will furnish

* Professor Playfair.